

CP, B's and CKM Matrix Elements

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PDG Advisory Meeting, CERN, Oct 11, 2008

- What's new in RPP 2008
- Issues in B's and CKM Elements
- Minireviews
- Prospects for 2010 Edition

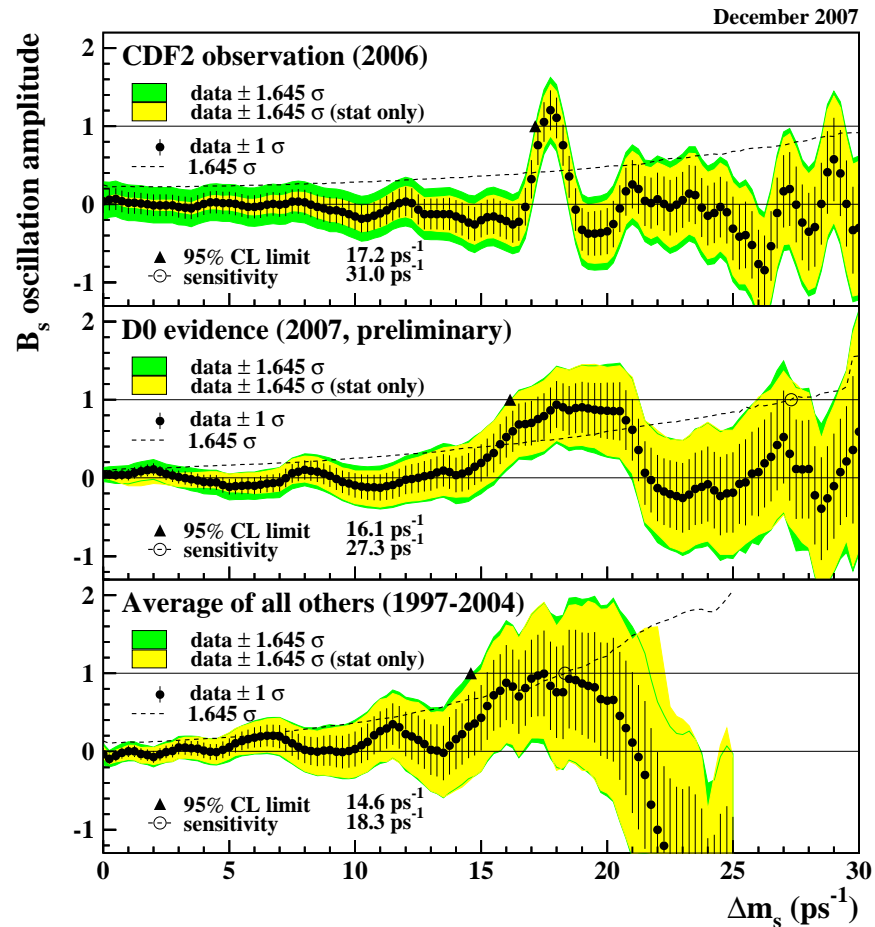
Encoders:

- Y. Kwon(Yonsei, Korea), Jim Smith(Colorado, USA) and Giovanni Punzi(INFN, Italy)
- With the help of Heavy Flavor Averaging Group (HFAG)

What's New in RPP 2008

- B physics continues to be one of the most productive fields in RPP.
- There were 182 papers and 859 measurements encoded since RPP2006.
- **Highlights:**
 - CPV and Unitarity Triangles
 - Bs Mixing and B lifetimes
 - Observation of new B hadrons states and Searches for rare B decays
 - Semileptonic B decays and V_{cb} and V_{ub} elements
- **Excellent minireviews:**
 - B production and Decays – Revised (Y. Kwon, G. Punzi, and J. Smith)
 - $B\bar{B}$ mixing – Revised (O. Schneider)
 - V_{cb}/V_{ub} determinations – Revised (B. Kowalewski and T. Mannel)
 - B polarization – Revised (A.V. Gritsan and J.G. Smith)

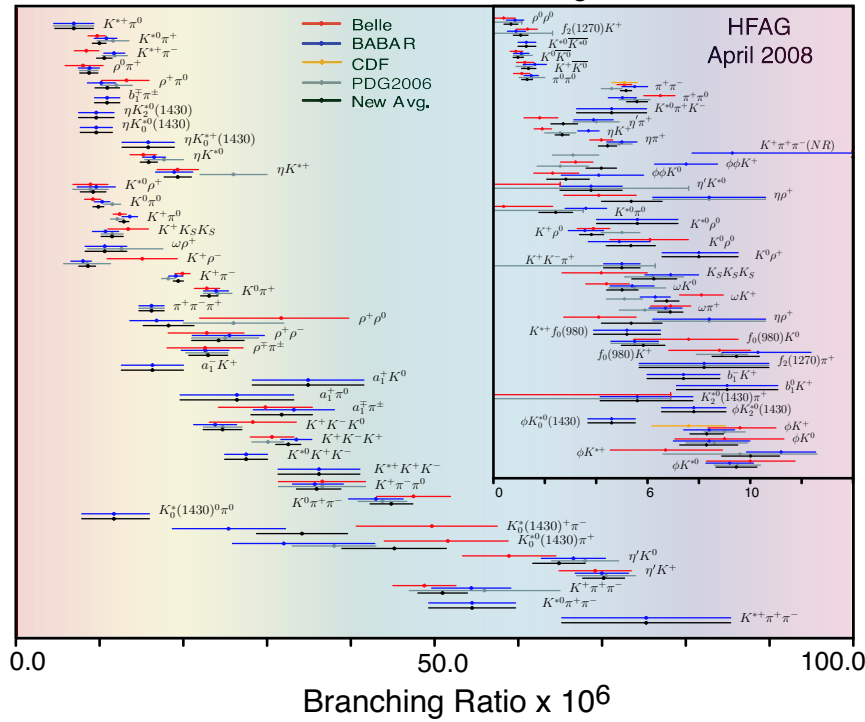
Observation of B_s Mixing



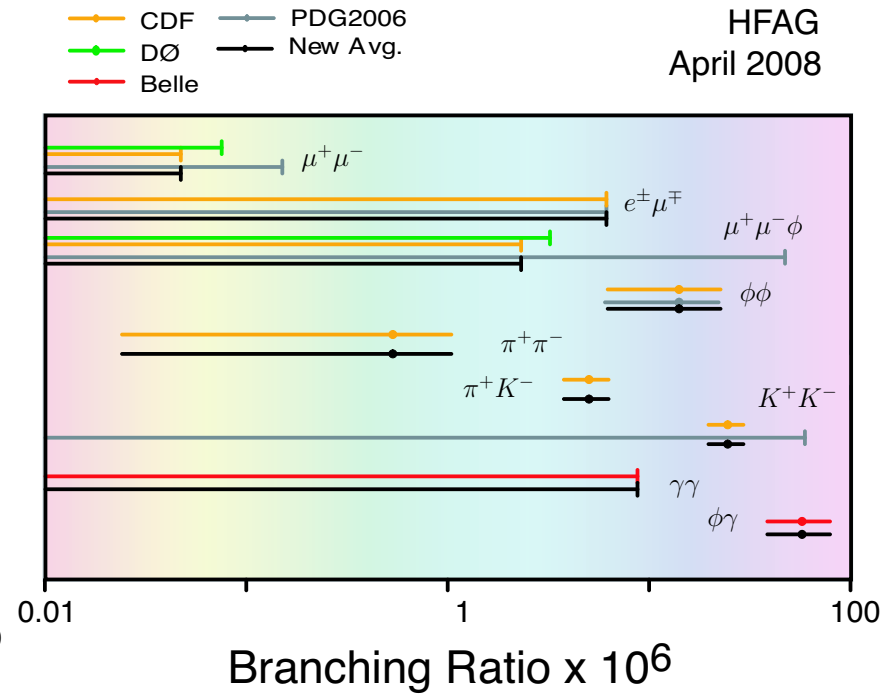
- $\Delta m_s = 17.77 \pm 0.10 \pm 0.07 (\text{ps}^{-1})$
- $|V_{td}/V_{ts}| = 0.2060 \pm 0.0012_{-0.0060}^{+0.0080}$

Rare Decays and Searches

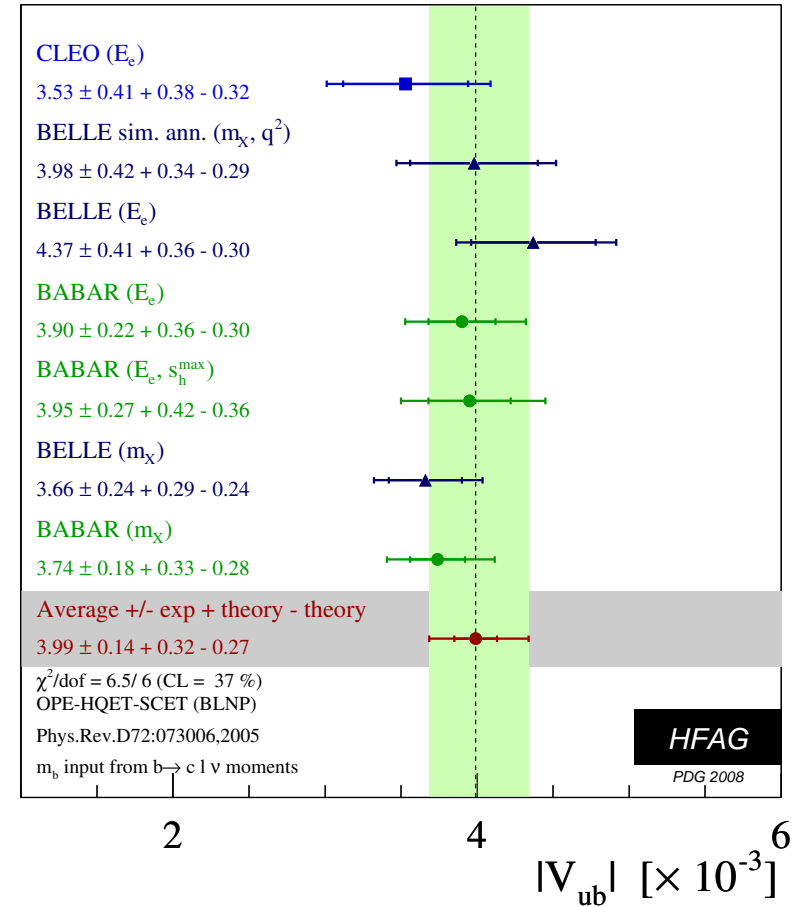
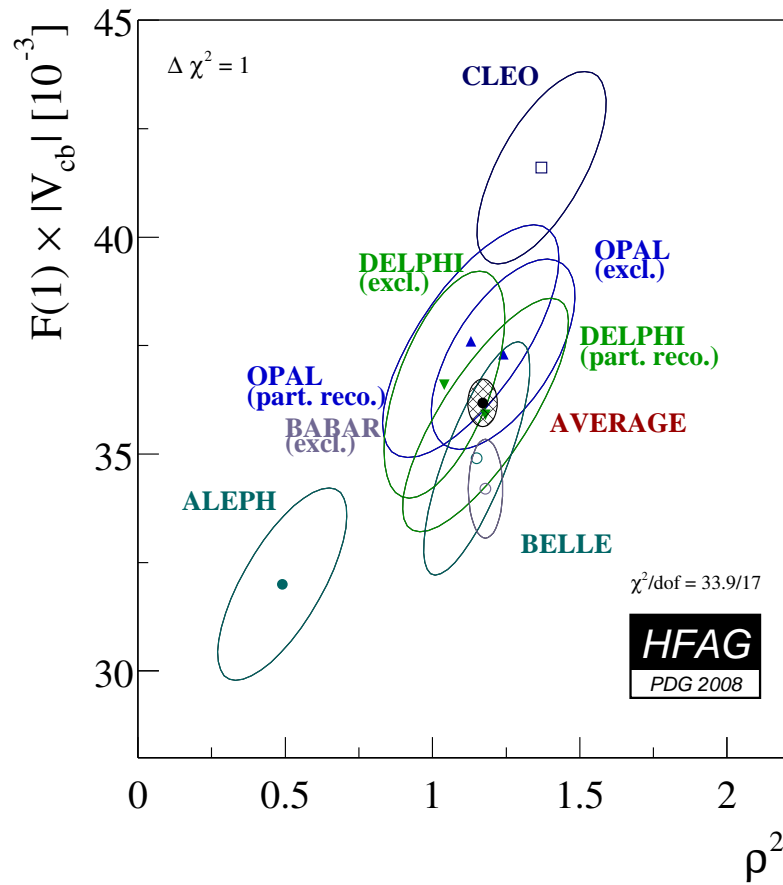
Charmless Mesonic B Branching Fractions



Rare Bs Decay Modes

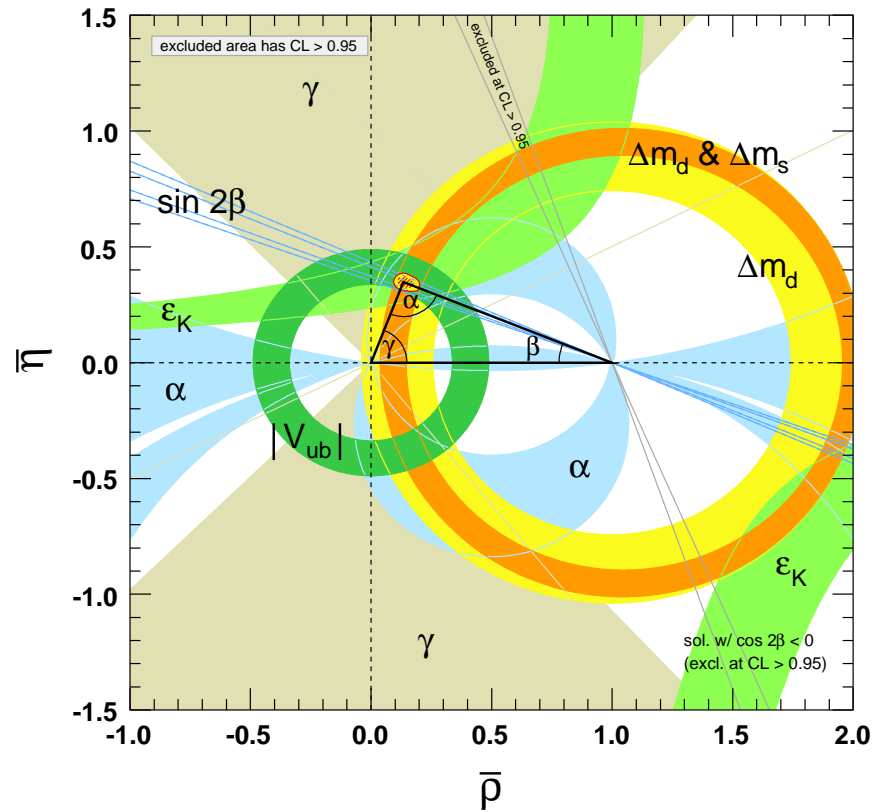
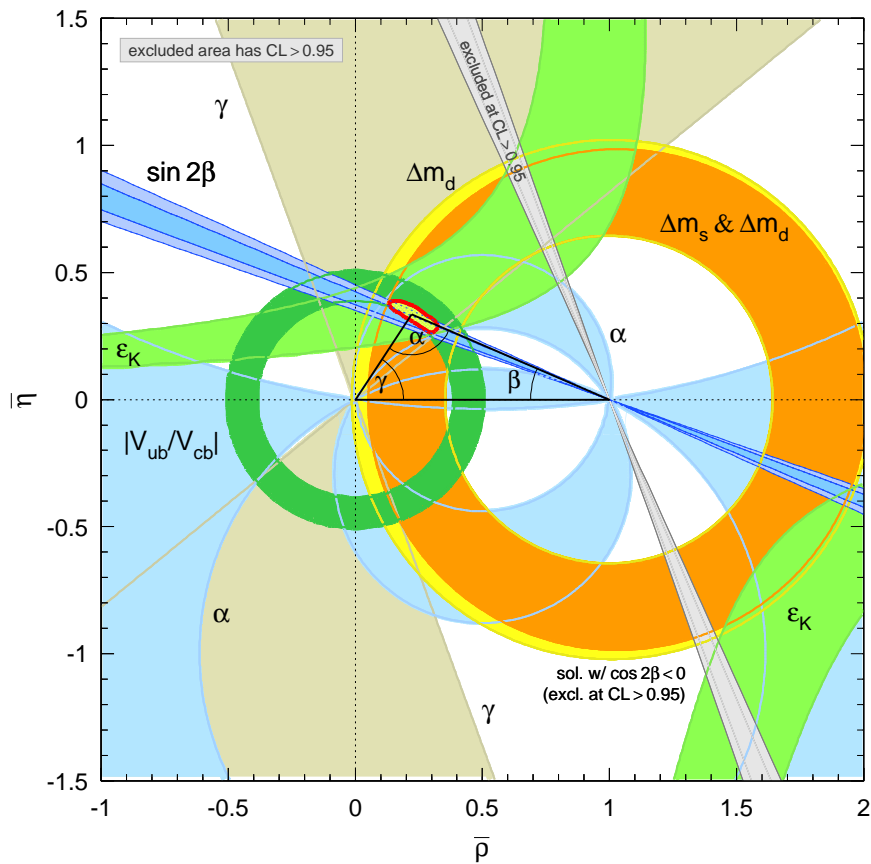


$|V_{cb}|$ and $|V_{ub}|$ Measurements



- $|V_{cb}| = (41.2 \pm 1.1) \times 10^{-3}$
- $|V_{ub}| = (3.95 \pm 0.35) \times 10^{-3}$

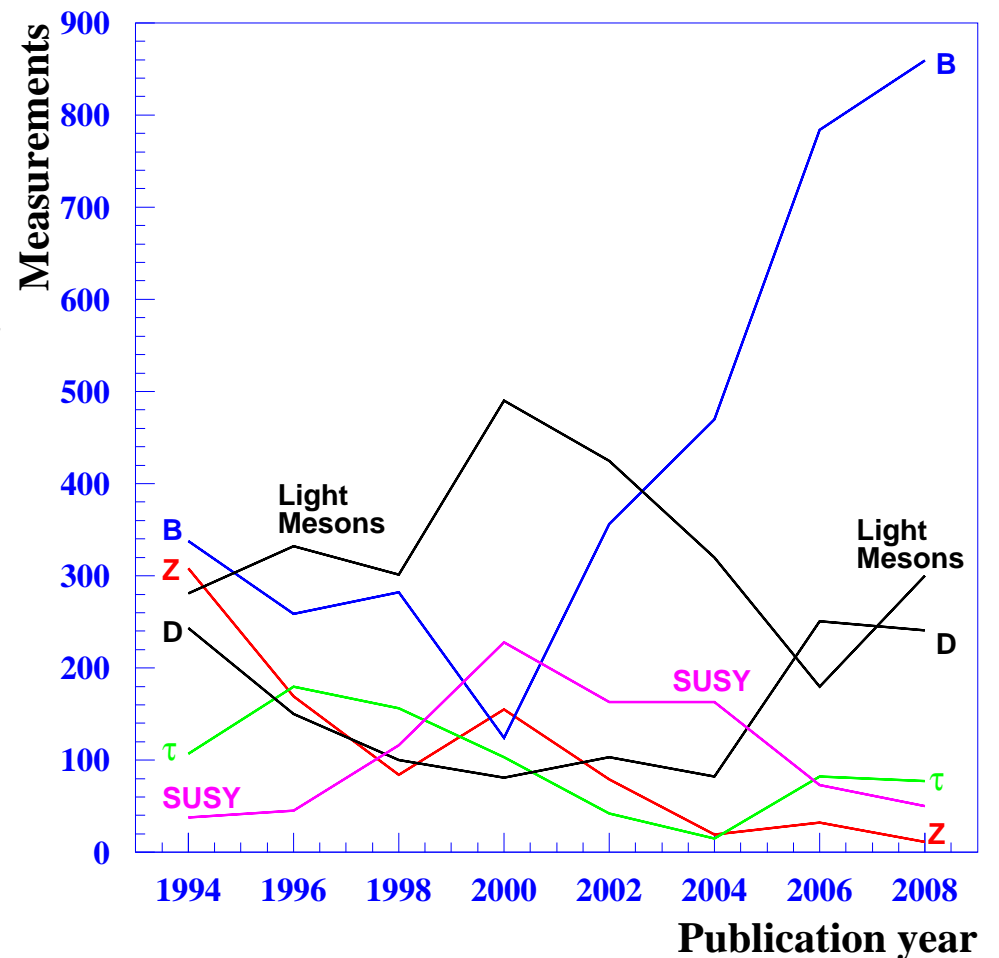
CKM Fits



- Left: 2006 CKM fit; Right: 2008 CKM fit
- A significant improvement is evident.

Encoded B Measurements

- The number of B measurements increased significantly per edition since 2000.
- Expected to level off until Super B era.



Outside Working Groups (HFAG)

- The PDG averaging method is not designed for handling possible correlations in statistical and systematic error between measurements and experiments.
- We have to rely heavily on the outside working groups and their expertise to provide the best averages for PDG, which use only published results.
- HFAG have provided their averages for PDG for many years now, whose combination procedure takes all known correlations into account as well as rescaling each individual measurements using the common set of input parameters before averaging.
- HFAG consists of 6 subgroups: B Lifetimes and Mixing, Semileptonic B Decays, Unitarity Triangle, Rare B Decays, $b \rightarrow c$ Decays, and Charm Physics
- They will continue despite BaBar is going to phase out soon.

Branching Fraction Rescaling

- It would not be possible to update all the existing measurements for each edition when there are better input branching ratios available.
- This would not be a problem for most interesting measurements since the measurement are periodically updated.
- Some of them were automatically updated via branching ratio rescaling.
- But some legacy measurements that involved multiple branching fractions, they were not updated.
- We got some complains and will try to fix as we go.

CKM elements

- Most CKM elements are measured based on branching ratios or decay asymmetry with some help of theoretical assumptions.
- They were discussed in details in mini-review or CKM review.
- However, their listings are in many different sections, for example, in Kaon, Charm, and B sections.
- Radiative B decays (BELLE):
 - $B(B \rightarrow \rho\gamma)/B(B \rightarrow K^*\gamma) = |V_{td}/V_{ts}|^2/\xi^2$
 - $|V_{td}/V_{ts}| = 0.21 \pm 0.04$ for $\xi = 1.2 \pm 0.2$
- Bs mixing (CDF):
 - $\Delta m_s = 17.77 \pm 0.10 \pm 0.07 (ps^{-1})$
 - $|V_{td}/V_{ts}| = 0.2060 \pm 0.0012_{-0.0060}^{+0.0080}$
- In the future, we may want to reorganize the section.

Revised V_{cb} and V_{ub} Minireview

B. Kowalewski and T. Mannel

- Following the previous PDG advisory committee's recommendation, we have successfully combined two separate V_{cb} and V_{ub} minireview into a single coherent review, which covers both theoretical and experimental issues regarding V_{cb} and V_{ub} measurements
- The authors have done a nice job to describe both theoretical and experiment issues involved in the measurements.
- The review has significantly revised to reflect the progresses made since last edition.
- The values obtained from inclusive and exclusive determinations are consistent each other and an average values is used for the final result.
 - $V_{cb} = (41.2 \pm 1.1) \times 10^{-3}$
 - $V_{ub} = (3.95 \pm 0.35) \times 10^{-3}$

Prospects for 2010 Edition

- Continue to work with Heavy Flavor Averaging Group providing the world best B decay parameters
- Planning for data driven minireviews
 - V_{cb} and V_{ub} CKM Elements
 - Production and Decay of b-flavor Hadrons
 - Polarization in B decay
 - B Mixing
 - ...
- All the data are consistent with Standard Model so far, will see if that still holds at 2010.
- This is an exciting time for flavor physics, just rewarded for 2008 Noble Prize in physics and we will continue to meet the challenges in LHC and super B era.